5.1.1: Going Around the Curve

Experiment A

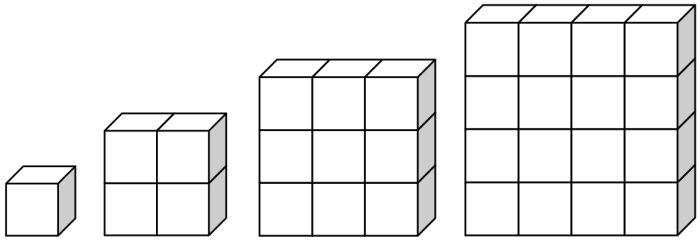
A particular mould grows in the following way: If there is one “blob” of mould today, then there will be 4 tomorrow, 9 the next day, 16 the next day, and so on.

Hypothesis

What type of relationship do you think exists between the side length and the number of cubes?

Procedure

1. Build the following sequence of models, using linking cubes.

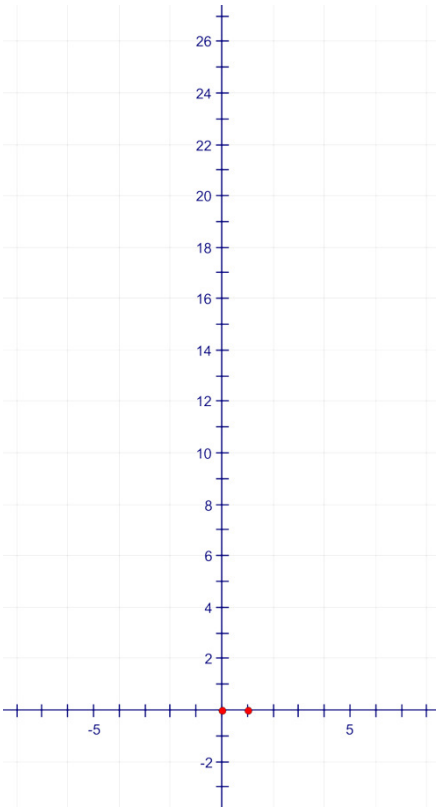


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences. Make a scatter plot and a draw a line or curve of best fit (whichever is most appropriate for the data).

Side Length	Number of Cubes	First Differences	Second Differences
0	0		



5.1.2: Going Around the Curve

Experiment B

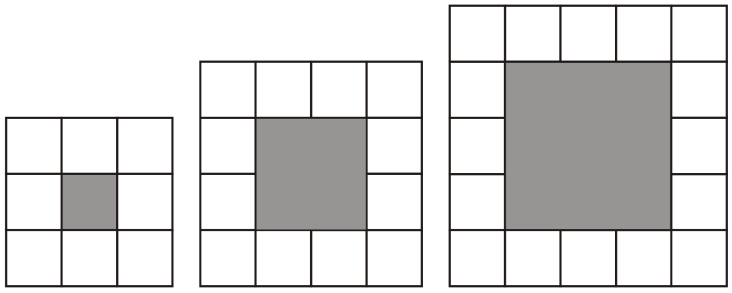
Jenny wants to build a square pool for her pet iguana. She plans to buy tiles to place around the edge to make a full play area for her pet.

Hypothesis

What type of relationship do you think exists between the side length of the pool and the total play area (pool combined with edging)?

Procedure

1. Build the following sequence of models using linking cubes.
   Note: The pool is the shaded square, the tiles are white.

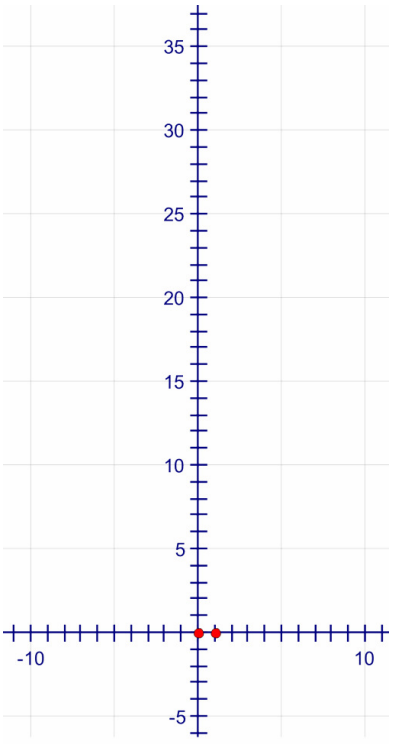


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences. Make a scatter plot and a draw a line or curve of best fit (whichever is most appropriate for the data).

Side Length	Total Play Area	First Differences	Second Differences
1			



5.1.3: Going Around the Curve

Experiment C

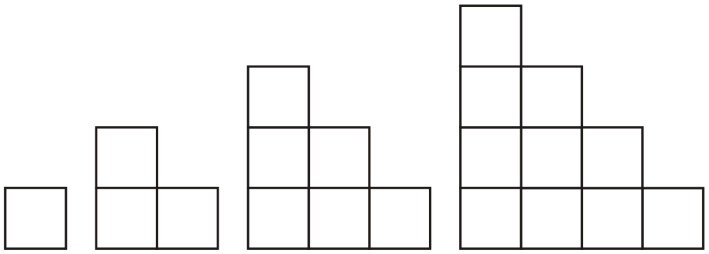
A particular mould grows in the following way: If there is one “blob” of mould today, then there will be 3 tomorrow, and 6 the next day.

Hypothesis

What type of relationship do you think exists between the number of cubes in the bottom row and the total number of cubes?

Procedure

1. Build the following sequence of models using linking cubes.

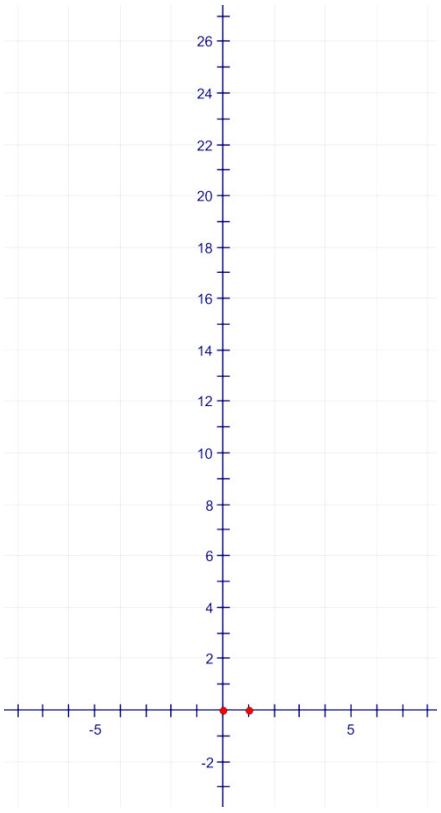


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences. Make a scatter plot and a draw a line or curve of best fit (whichever is most appropriate for the data).

Number of Cubes in the Bottom Row	Total Number of Cubes	First Differences	Second Differences



5.1.4: Going Around the Curve

Experiment D

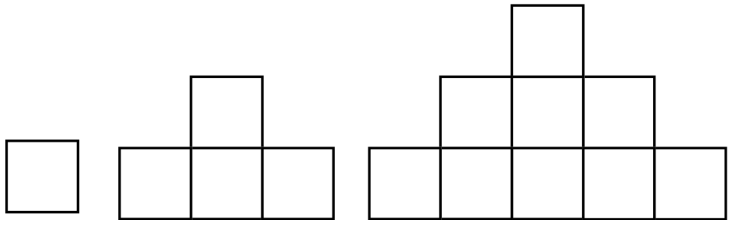
Luisa is designing an apartment building in a pyramid design. Each apartment is a square. She wants to know how many apartments can be built in this design as the number of apartments on the ground floor increases.

Hypothesis

What type of relationship do you think exists between the number of cubes in the bottom row and the total number of cubes?

Procedure

1. Build the following sequence of models using linking cubes.

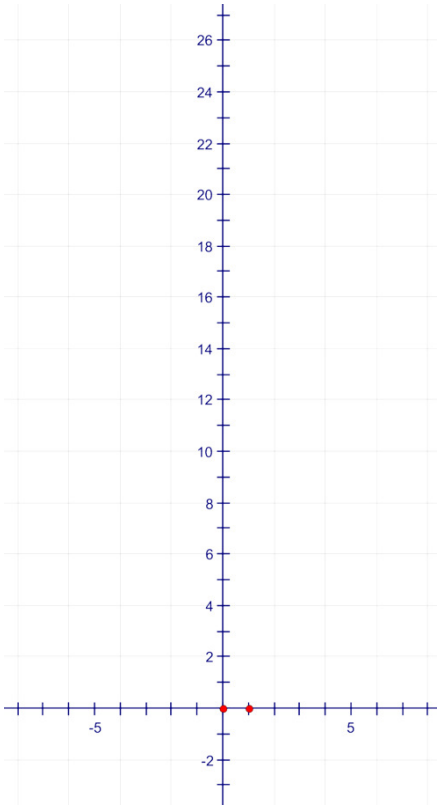


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences. Make a scatter plot and a draw a line or curve of best fit (whichever is most appropriate for the data).

Number of Cubes in the Bottom Row	Total Number of Cubes	First Differences	Second Differences
0	0		



5.1.5: Going Around the Curve

Experiment E

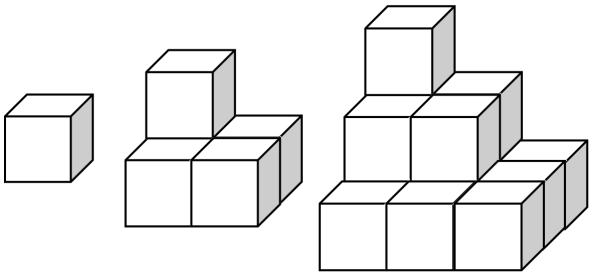
Liz has a beautiful pond in her yard and wants to build a tower beside it using rocks. She is unsure how big she will make it and how many rocks she will need. She is particularly concerned to have the nicest rocks showing. We will model this situation using linking cubes for rocks.

Hypothesis

What type of relationship do you think exists between the length of the side of the base and the number of visible cubes?

Procedure

1. Build the following sequence of models using the cubes.

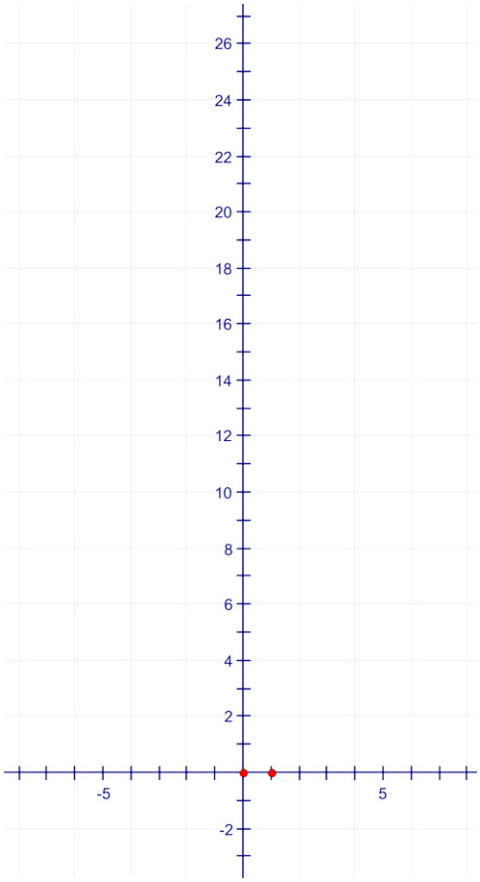


2. Build the next model in the sequence.

Mathematical Models

Complete the table, including first and second differences. Make a scatter plot and a draw a line or curve of best fit (whichever is most appropriate for the data).

Length of Side of Base	Total Number of Unhidden Cubes	First Differences	Second Differences
1			

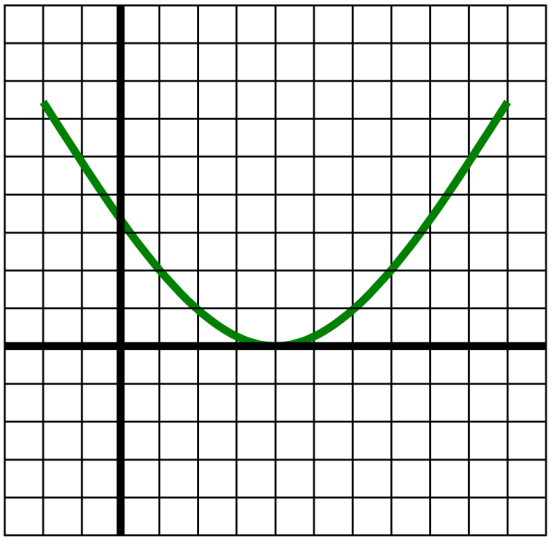


5.3.2: Key Features of Quadratic Relations

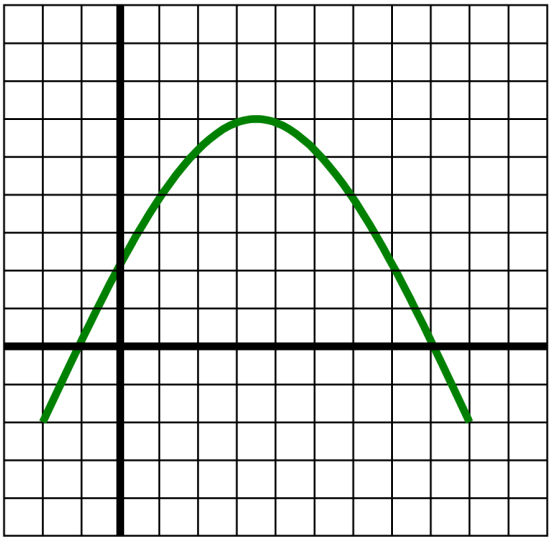
Terminology	Definition	How Do I Label It?	Graph A	Graph B
Vertex	The maximum or minimum point on the graph. It is the point where the graph changes direction.	(x,y)		
Minimum/ maximum value				
Axis of symmetry				
y-intercept				
x-intercepts (zeros)				

Label the graphs using the correct terminology.

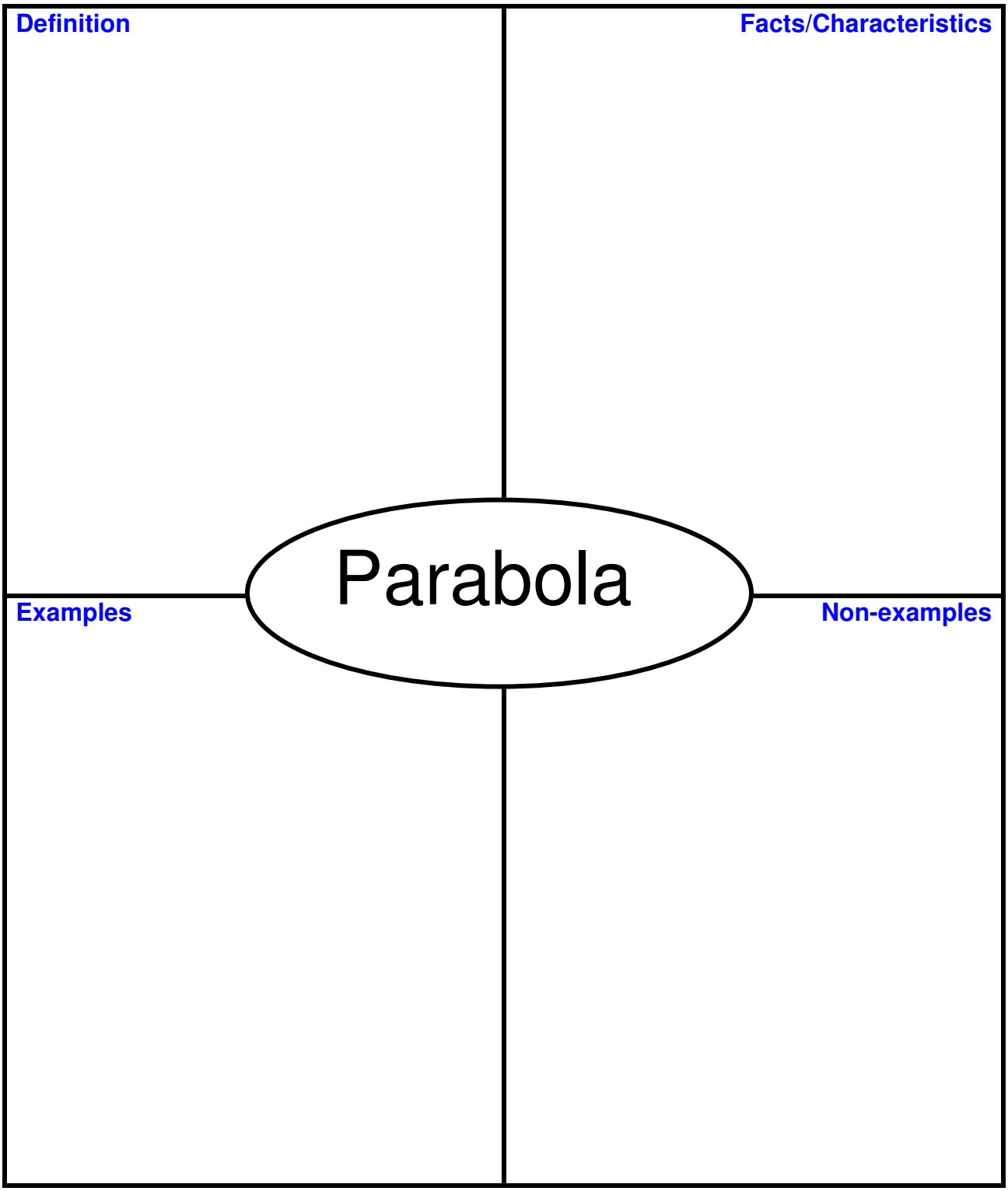
Graph A



Graph B



5.4.1: Key Features of a Parabola



5.4.2: Quadratic Power – Modelling Canada's Baby Boom

Your Task

The Baby Boom occurred right after World War II. Determine if a parabola can be a useful model for the number of births per year for this post-war Baby Boom period.

Procedure

To access Canada's Baby Boom data

1. Open the E-STAT website at http://estat.statcan.ca.
2. Select your language of choice. Click **Accept and Enter** at the bottom of the screen.
3. Click **Search CANSIM** on the left side bar and then click **Search by Table Number**.
5. In the blank box, type **053-0001** to retrieve Table 053-0001 – Vital statistics, births, deaths, and marriages, quarterly.
5. On the subset selection page choose as follows:
   - Under Geography, select **Canada**
   - Under Estimates, select **Births**
   - Under From, select **Jan. 1950**
   - Under To, select **Dec. 1967**
6. Click the **Retrieve as Individual Time Series** button.
7. In the Output specification screen under output format selection, click the **down arrow** and select **Plain Text Table, Time as Rows**.
8. From "The frequency of the output data will be" pull-down menu, select **Converted to Annual (Sum)**.
9. Press the **Go** button.
10. Record the data on a sheet of paper using the following headings: Year and Births.

Year	Births
1950	372009
1951	381092
1952	403559
1953	417884
1954	436198
1955	442937
1956	450739
1957	469093
1958	470118
1959	479275
1960	478551
1961	475700
1962	469693
1963	465767
1964	452915
1965	418595
1966	387710
1967	370894

Graphing Calculator Analysis

1. Create a Births vs. Year scatter plot on your graphing calculator.
2. Perform a Linear Regression on your graphing calculator. Write the equation of the line.
3. How well does the Linear Regression fit the data?
5. Perform a Quadratic Regression on your graphing calculator. Write the equation of the line.
5. How well does the Quadratic Regression fit the data?
6. Which regression best describes the data?

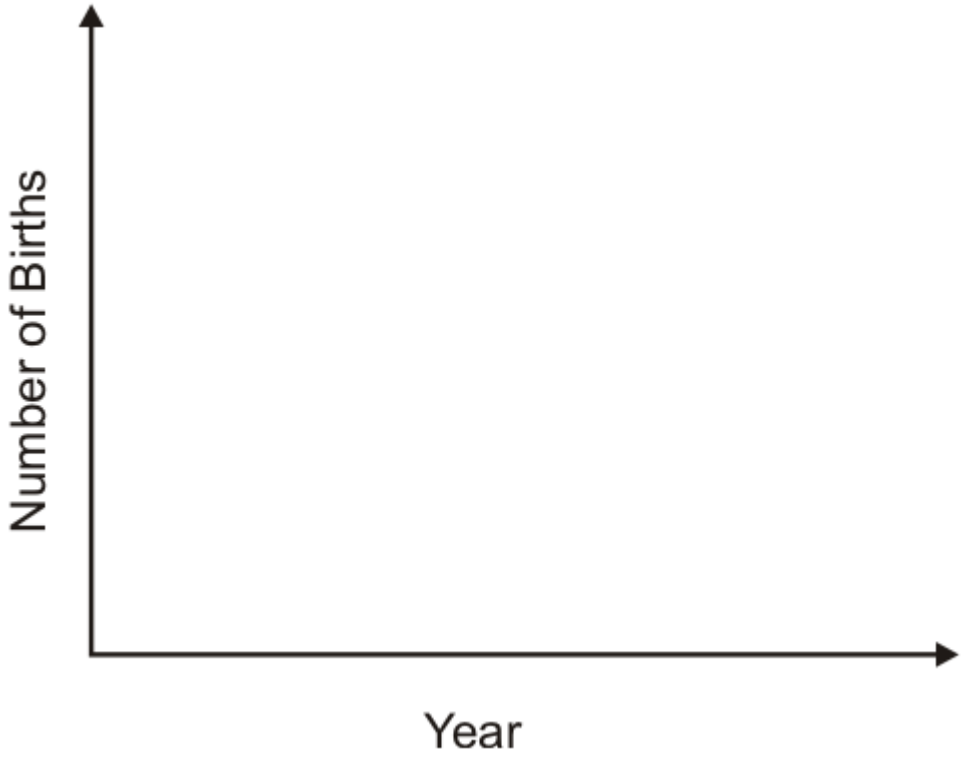
Source:
http://www.keypress.com/fathom/pages/community_exchange/activities_and_documents/activities.php

5.4.3: Modelling Canada's Baby Boom

You examined Baby Boom births in Canada, between 1950–1967.
Sketch what you think the graph of the number of births in Canada between 1950–2005 might look like.

Explain your reasoning and any assumptions you made.

Births in Canada 1950–2005



5.5.1: Ball Bouncing Instructions

Record your hypothesis on the Ball Bouncing Record Sheet.
Use the CBR and the graphing calculator to examine the relationship between the bounce heights of your ball versus time after it is dropped from 1 m.

Instructions to Use Technology

1. Press the APPS button on your calculator and select **CBR/CBL**.
2. Follow the instructions on the calculator screen and press **ENTER**.
3. Run the Ranger program on your calculator.
5. From the main menu of the Ranger Program, select **3:APPLICATIONS**.
5. Select **1:METERS** and then select **3:BALL BOUNCE**.
6. Follow the directions on the screen of your calculator. Release the ball so that the bottom of the ball is 1 m above the floor. The CBR should be at the same height as the bottom of the ball. Drop the ball and then press the trigger key on the CBR just before the ball strikes the ground. Try to keep the CBR steady as it collects the data. This may take a little practice.
7. Your graph should have a minimum of 3 bounces. If you are not satisfied with the results of your experiment, press **ENTER**, select **5:REPEAT SAMPLE**, and try again. Repeat it until you get a nice graph of the ball bouncing.

Data Collection

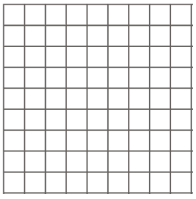
The goal is to capture the motion of the ball that represents the period from the first bounce to the second bounce.

1. Press **ENTER** to return to the PLOT MENU. Select **7:QUIT** to exit the Ranger Program. The data that you will work with will be in L1 and L2.
2. Use the built-in Select feature of the calculator to select the data you want. Follow the keystrokes below.
   a) Press **2nd [STAT]**, scroll over to OPS menu and then scroll down to #8:SELECT, (and press **ENTER**.
   b) After the bracket (, enter where you want to store the selected data. To use L3 and L4, press **2nd L3 [,] 2nd L4** and **ENTER**.
   c) To actually select a part of the graph you will use, use the arrow keys to move to the left end of the parabola that you want to keep. This should be the first bounce. Press **ENTER**. This sets the left bound. Use the arrow keys to move to the right end of the parabola that you want. This should be the second bounce. Press **ENTER**. The selected data will be placed in L3, L4 and then this data will be displayed.
   d) Sketch a graph of this single parabola using the instructions and grid provided on your Ball Bouncing Record Sheet.
3. Repeat the experiment for each of the different balls.

5.5.2: Ball Bouncing Record Sheet

Hypothesis

1. We hypothesise the shape of the graph that represents the height of the ball over time will be _____

   Sketch the graph.  Explain your reasoning.

2. We hypothesise the time in the air between the first and the second bounce will be _____ for each ball.
   (*the same/different*)

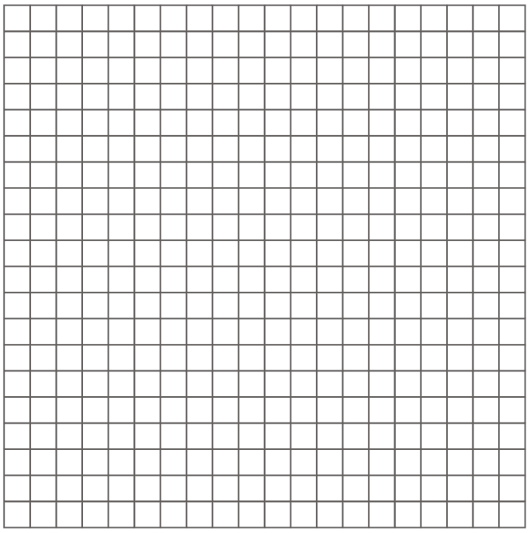
   Explain your reasoning.

Data Collection

Follow the steps described on the Ball Bouncing Instructions sheet.
To make a graph of each ball bounce, use the **TRACE** function or the **LIST** found using the **STAT** key **EDIT** from the graphing calculator, to complete the table of values for 7 points, starting at the first bounce and ending with the second bounce. Include the maximum point. Choose an appropriate scale to make an accurate sketch of the graph.

1. Ball type: _____

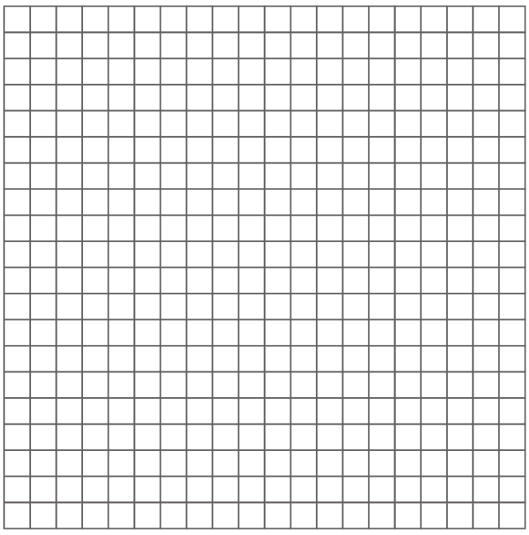
Times (s)	Height (cm)
	0
	(max)
	0



5.5.2: Ball Bouncing Activity (continued)

2. Ball type: _____

Times (s)	Height (cm)
	0
	(max)
	0



3. Ball type: _____

Times (s)	Height (cm)
	0
	(max)
	0